

TEKTRONIX®

**1105
POWER
SUPPLY**

INSTRUCTION MANUAL

Tektronix, Inc.
P.O. Box 500
Beaverton, Oregon 97005

070-1479-00

Serial Number _____

173

WARRANTY

All TEKTRONIX instruments are warranted against defective materials and workmanship for one year. Any questions with respect to the warranty should be taken up with your TEKTRONIX Field Engineer or representative.

All requests for repair and replacement parts should be directed to the TEKTRONIX Field Office or representative in your area. This will assure you the fastest possible service. Please include the instrument Type Number or Part Number and Serial Number with all requests for parts or service.

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TABLE OF CONTENTS

SECTION 1	SPECIFICATION	Page	SECTION 4	MAINTENANCE (cont)	Page
	Introduction	1-1		Battery Pack Service	4-1
	Specifications	1-1		Line Voltage Selection Wiring	4-2
	Safety Considerations	1-2		Ext DC Wiring	4-2
	Battery Charge Level	1-4		Option 1 Wiring	4-4
SECTION 2	FIRST TIME OPERATION AND INSPECTION		SECTION 5	CALIBRATION	
	Functions of Controls, Indicators, and Connectors	2-1		Introduction	5-1
	Operating Modes For Inspection	2-1		Equipment Required	5-1
	Battery Operation	2-2		Calibration Procedure for Standard Instrument	5-3
SECTION 3	CIRCUIT DESCRIPTION			Calibration Procedure for Option 1	5-4
	Introduction	3-1	SECTION 6	DIAGRAMS, ILLUSTRATIONS AND PARTS LISTS	
	Block Diagram	3-1		Electrical Parts List	
	Meter and Cut-off Volts Circuit	3-1		Setup and Waveforms	
	Battery Charger Circuit	3-6		Electrical and Circuit Board Layout	
	Start-Inverter Circuit	3-6		Power Supply Schematic	
	External DC Input	3-9		Mechanical Parts List	
SECTION 4	MAINTENANCE			Exploded View Drawings	
	Obtaining Replacement Parts	4-1			

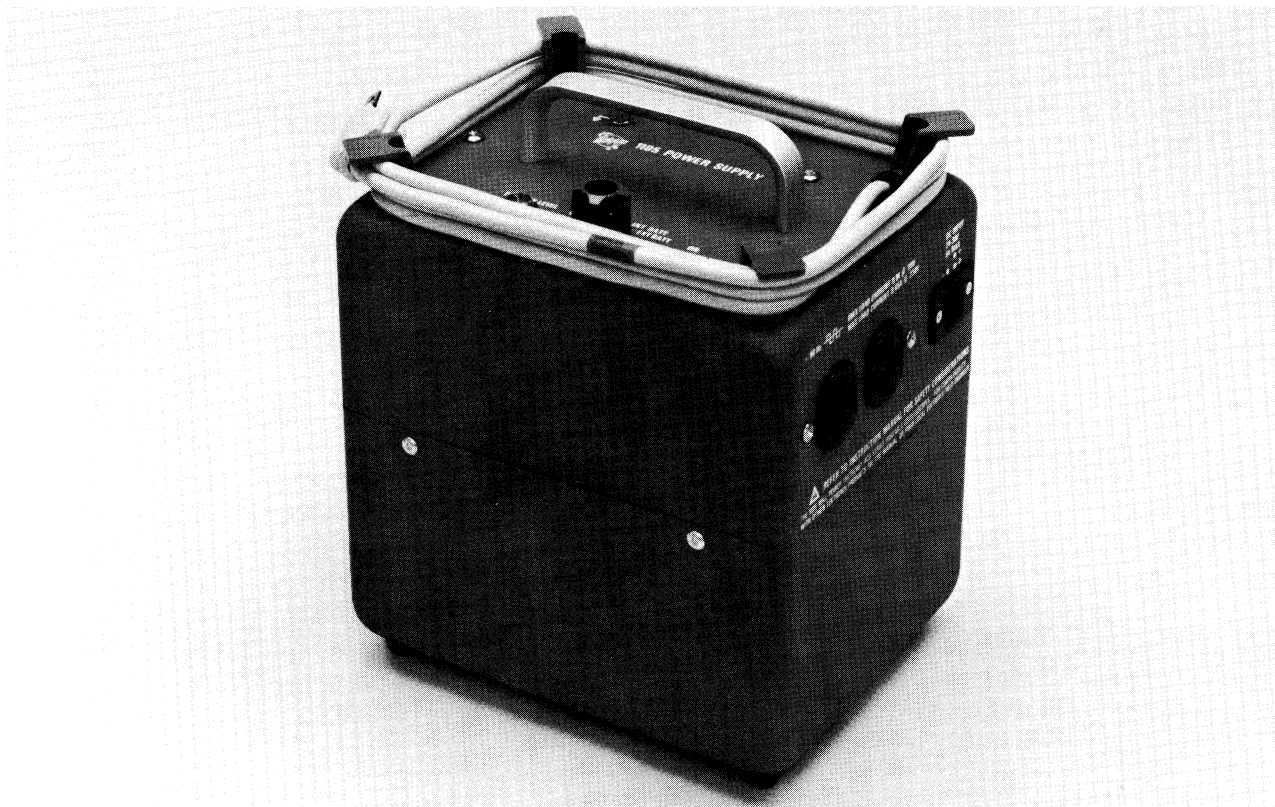


Fig. 1-1. 1105 Power Supply

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MANUAL CHANGE INFORMATION

TITLE GENERALCHANGE REFERENCE S23,351DATE 4-10-75**CHANGE:****DESCRIPTION**

POWER CORD CHANGES

The 1974 National Electrical Code permits the use of IEC (International Electrotechnical Commission) power cord color codes. As production permits, we are changing the entire Tektronix product line to comply with IEC power cord color code requirements. As a result, the power cord on Tektronix instruments may conform to either IEC or the older NEC requirements. The change consists of the following:

Conductor	NEC	IEC
Line	Black	Brown
Neutral	White	Light Blue*
Safety Earth	Green w/Yellow Stripe	Green w/Yellow Stripe

*Tinned copper conductor.

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MANUAL CHANGE INFORMATION

TITLE 1105CHANGE REFERENCE C2/675

EFF ALL SN

DATE 6-3-75**CHANGE:****DESCRIPTION**

MECHANICAL PARTS LIST CORRECTIONS

Page 6-17 Fig. & Index No. 2-32

CHANGE TO:

-32 161-0033-14 1 CABLE ASSEMBLY, power (Standard 1105)

161-0098-00 1 CABLE ASSEMBLY, power (Option 1, only)

Page 6-22

ACCESSORIES

CHANGE: 161-0094-01 to read 161-0094-00

CHANGE: 161-0086-00 to read 161-0086-02

SPECIFICATION

INTRODUCTION

The 1105 Power Supply is a battery-pack power supply intended to provide operating power for Tektronix 400-Series Oscilloscopes.

Battery power allows operation away from AC power sources, measurements with floating grounds and isolation from user circuits and their line transients, EMI, etc.

The separate battery pack capability permits a choice of battery operation or AC line operation. Battery operation does not compromise oscilloscope performance.

During battery pack recharging, the oscilloscope may still be used elsewhere, either with another battery pack or AC line.

The 24 to 30 volt external input permits use with conventional DC power (marine and aircraft).

The 1105 Power Supply is offered in both 115 volts and 230 volts, IEC (Option 1) versions. Option 1 differences are so indicated throughout this manual.



The 1105 Power Supply has a square-wave output. If equipment other than Tektronix 400-Series instruments is to be supplied by the 1105, make sure that it can safely operate from a square-wave supply such as the 1105.

For compatibility with other Tektronix products contact your local Tektronix Field Engineer.

For use with other than Tektronix products contact the vendor.

SPECIFICATIONS

AC Requirements. AC power source is required only for battery charging. Standard instrument: 100 to 130 VAC,

50 to 400 Hz. Option 1: 200 to 264 VAC, 50 to 400 Hz. Power consumption is approximately 35 watts.

The standard instrument will operate with a 90 to 120 VAC power source with an internal connection change. See the maintenance section of this manual for further information.

The Option 1 instrument will operate with a 180 to 240 VAC power source by making the same internal change.

DC Requirements. 24 to 30 V. DC power source is required to maintain 22 V with a starting surge of 8 to 10A. Maximum elevation for \pm power lead is 60 V with respect to chassis ground.

Power Output. Square-wave 60 Hz within 10%. Standard instrument: approximately 108 to 137.5 V, 0 to peak, with a 0.9 A load from a 22 to 28 V battery charge or external 24 to 30 V DC source. Option 1: approximately 216 to 275 V, 0 to peak, with a 0.45 A load from a 22 to 28 V battery charge or external 24 to 30 V DC source. Maximum recommended output current is 0.9 A (standard) or 0.45 A (Option 1).

Battery Operating Time. Approximately 140 watt-hours from fully charged internal batteries.

Battery Charge Time. 14 to 16 hours (0°C to 40°C) for batteries not completely discharged.

Temperature. Operating; 0°C to 40°C . 0°C to $+40^{\circ}\text{C}$ will not noticeably reduce the battery capacity. Storage outside of this range will reduce battery efficiency and capacity. Non-Operating; with batteries, -40°C to $+60^{\circ}\text{C}$; without batteries, -55°C to $+75^{\circ}\text{C}$.

Physical. 6.5 inches wide. 8.25 inches long. 9.8 inches high with the instrument feet and handle. Weight, 19.4 pounds.

SAFETY CONSIDERATIONS

The 1105 Power Supply has been designed and tested according to IEC Publication 348 "Safety Requirements for Electronic Measuring Apparatus", and has been supplied in safe condition. This instruction manual contains some informative and warning texts which the user must follow to ensure safe operation and to retain the 1105 Power Supply in safe condition.

The 1105 Power Supply meets the requirements of Safety Class I apparatus.

Charging

AC Power Sources. The instrument is intended to be operated from a single-phase power source having one current-carrying conductor (the Neutral Conductor) at ground (earth) potential. Operation from power sources where both current-carrying conductors are live with respect to ground (such as phase-to-phase on a three-wire system) is not recommended, since only the Line Conductor has over-current (fuse) protection within the instrument.

AC Power Cord. The instrument has a three-wire power cord with a three-terminal polarized plug for connection to the power source and safety-earth. The ground (earth) terminal of the plug is directly connected to the instrument frame. For electric-shock protection, insert this plug only in a mating outlet having a safety earth contact.

DC Power Input Cord. The instrument is provided with a three-wire power cord for connection to the power source and safety-earth. The ground (earth) conductor is directly connected to the instrument frame. For electric-shock

protection, connect the safety-earth conductor to a ground (earth) reference. This grounding is required for proper shielding.

TABLE 1-1
Power Cord Color Code

CONDUCTOR	115 VAC 230 VAC USA & CANADA	OPTION 1 230 VAC	EXT DC
Line	Black	Brown	Red (+)
Neutral	White	Blue	Violet (-)
Safety Earth	Green/ Yellow	Green/ Yellow	Green/ Yellow

Operating

When only one apparatus is powered by the 1105 Power Supply, the potential at the cabinet (frame) of the 1105 Power Supply is established by the powered apparatus through the safety-earth conductor. For electric-shock protection, connect either the 1105 cabinet (frame) or the apparatus powered by the 1105 Power Supply to a ground (earth) reference.

When more than one apparatus is powered by the 1105 Power Supply, the potential at the cabinet (frame) of the

1105 Power Supply can be established by either powered apparatus through the safety-earth conductor system. For electric-shock protection, connect the 1105 cabinet (frame) to a ground (earth) reference.

When the 1105 Power Supply supplies power to another apparatus, both the Line and Neutral Conductors are live with respect to ground. When servicing the powered apparatus, an electric-shock hazard exists from the Neutral Conductor as well as the Line Conductor.

Servicing

Before disassembling the 1105 Power Supply for servicing, disconnect the 1105 from the power source. This avoids the possibility of electric shock during disassembly.

DANGER

With the power cord disconnected, the internal battery provides power. With the instrument disassembled, live parts are exposed and accessible.

BATTERY CHARGE LEVEL

Meter indication of battery charge level may be false during the first several minutes of battery operation. This is due to a battery characteristic.

When the power supply is turned on, a residual battery charge may give a meter indication of a high state-of-charge even though a low, partial charge is all that remains. The power supply may operate several minutes, under load, before this partial charge is depleted.

This characteristic may show up after the battery pack has been discharged and the instrument turned off. It may also show up after the instrument has been stored in temperatures significantly below 25°C, then brought to room temperature for operation.

If unsure of the state of the battery charge, recharge at the proper temperature for the full recharge time given in the battery operation section.

FIRST TIME OPERATION AND INSPECTION

FUNCTION OF CONTROLS, INDICATORS AND CONNECTORS

Mode Switch

OFF. Instrument input and output power are turned off.

CHG (Charge). Internal batteries charge when instrument is connected to appropriate power line. Output power is turned off.

INT BATT (Internal). Output power is made available and Inverter Circuit is operated from internal batteries.

EXT BATT (External). Output power is available and Inverter Circuit is operated from external DC power.

BATT LEVEL (Battery Level)

Meter indicates the approximate state of charge of the internal battery pack, while under load.

DC INPUT (Ext. DC Input)

Input connector for external DC power to operate the 1105 Power Supply.

ON

Lamp shows power supply is operating on INT BATT, EXT BATT or when power supply is charging.

OPERATING MODES FOR INSPECTION

An incandescent lamp, 75 watts or less, is an adequate load for verifying the operating modes. For selection of other loads and the external DC power supply see the calibration section. Table 2-1 lists the inspection requirement for each mode.

TABLE 2-1

MODE	EXT POWER APPLIED	ON LIGHT	Meter Indicates	OUTPUT	INSTRUMENT STATUS
INT BATT	None	On	Approximate Internal Volts	Yes	Correct
INT BATT	None	Off	0	0	Batteries discharged. See battery pack storage.
CHG	None	Off	0	0	Correct
CHG	AC Line	On	0	0	Battery charge too low. Charge for approximately 1 to 1.5 hours.
CHG	AC Line	On	Approximate Internal Volts	0	Battery Charge above 22 V. Continue charging. See battery pack storage.
EXT BATT	None	Off	0	0	Correct
EXT BATT	Ext 24 to 30 V DC	On	Approximate Internal Volts	Yes	Correct ¹

¹ Failure to start with External DC is usually the inability of the DC Power Source to handle the starting surge.

BATTERY OPERATION

WARNING

The nickel-cadmium (NiCd) cells used in this instrument are capable of delivering a large amount of current in a short time. Care must be taken not to

short-circuit the cells. The battery pack is fused at 6.25 amperes.

First Time Operation. The instrument may be operated with less than fully charged batteries. For first time operation, however, the battery pack should be completely recharged before use.

Operating Time. Battery operating time depends on the load selected and the charge-discharge temperatures. Optimum charge and discharge is obtained when the batteries are operating at temperatures between 20°C to 30°C. Relative capacities for other temperatures are shown in Table 2-2. Battery pack discharge curves are given in Fig. 2-1.

NOTE

High discharge rates or high ambient temperatures may raise the battery temperature enough to lower their 140 watt-hour capability.

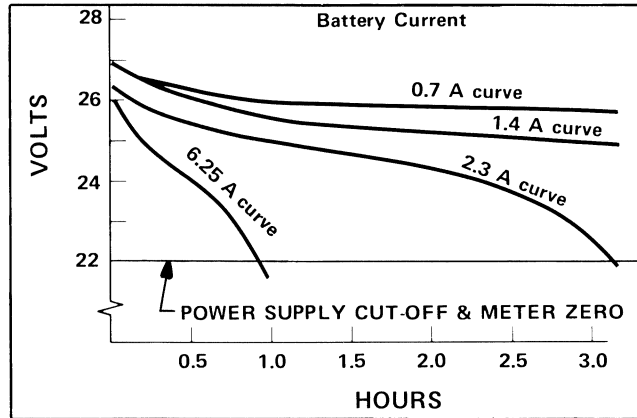


Fig. 2-1. Typical battery-pack discharge curves.

TABLE 2-2
Typical Battery Charge Capacity

(referenced to charge-discharge at +20°C to +30°C)

Charge Temperature	Operating Temperature		
	-15°C	+20°C to +30°C	+55°C
0°C	40%	60%	50%
+20°C to +30°C	65%	100%	85%
+40°C	40%	65%	55%

TABLE 2-3
Approximate Battery Pack Operating Times With Recommended Tektronix Instruments

Type	Time
432	3.2 hours
434	1.7 hours
453	1.4 hours
454	1.2 hours
465	2.7 hours
475	1.7 hours
485	2.3 hours

Battery Discharge. The 1105 has a circuit to cut off the power supply to protect it and the load. The battery pack will continue to discharge through the internal circuitry if the mode switch is left in INT BATT position.

Excessive discharge of the battery pack after the ON light goes out may cause one or more cells to reverse polarity. Although the cells are protected against immediate damage, repeated polarity reversal will shorten the useful life of the batteries.

Battery Charge. A Thermal cutout in the Power Supply protects the battery pack from overheating during charge time. The battery pack normally becomes warmer as it reaches full charge potential. If the temperature surrounding the battery pack exceeds the safe operating level, a thermal cutout switches the charge rate from the 600 milliamperes full-charge to the 250 milliamperes trickle-charge rate. When the temperature returns to a safe operating level, the thermal cutout returns the charge rate to the 600 milliamperes level. Although the batteries may not be damaged immediately by longer charge periods, repeated over-charging will shorten the useful life of the batteries.

During normal usage or storage, each battery cell in the battery pack acquires a slightly different charge character-

istic. To provide the best overall operation and maximum operating life, the charge on the individual battery cells should be equalized periodically. This can be done without damage to the battery cells by charging the batteries for 24 hours. Charging should be done after every 15 charge-discharge cycles or every 30 days, whichever occurs first.

Battery Pack Storage. The battery pack used in the 1105 Power Supply can be stored in a charged or a partially-charged condition. For best shelf time when storing the battery pack for long periods of time, fully recharge the battery pack about every three months. Although the battery pack is fully charged when shipped from Tektronix, Inc., recharge the battery pack completely before operating the instrument.

Charge retention characteristics of nickel-cadmium batteries vary with the storage temperature and humidity. The battery pack may be stored at ambient temperatures between -40°C and $+60^{\circ}\text{C}$ without damage, either in the instrument or as a separate unit. The self-discharge rate increases with an increase in ambient temperature. For example, cells stored at $+20^{\circ}\text{C}$ will lose about 50% of their stored charge in three months, but when stored at $+50^{\circ}\text{C}$, they will be almost completely self-discharged in only one month. High humidity also increases the rate of self-discharge.

CIRCUIT DESCRIPTION

Introduction

The 1105 Power Supply provides a 60 Hz, square-wave power source. The output voltage is available in the INT BATT mode, using the internal battery pack, or in the EXT BATT mode, using a suitable external DC supply. The CHG mode disconnects the output plugs and permits recharging of the internal battery pack. A meter circuit indicates approximate battery voltage for the internal batteries or the external DC supply. The meter circuit indicates battery voltage during recharge. A low voltage circuit shuts the inverter off when the internal or external DC level falls below 22 V.

Block Diagrams

Charge. See Fig. 3-1. AC power is applied to T161 primary. Part of the secondary voltage is applied to a full-wave bridge rectifier, CR145. The output of CR145 is applied across the charger circuitry and the battery, meter and cut-off voltage circuitry. Meter M123 will indicate charge voltage when the battery charge exceeds 22 V. The remaining circuitry is disconnected or disabled.

Internal Battery. See Fig. 3-2. Battery voltage is applied to meter and cut-off voltage circuitry. Battery voltage is applied to the start circuitry, (Q106 and T101) and also to the inverter transistors (Q104 and Q108 through T161).

The internal battery may discharge below 22 V. At this time, the output of Q136 is low, turning on diodes CR101 and CR102. This shorts out a winding on base transformer T101 and prevents the inverter from running. This also happens if the battery has insufficient charge to maintain more than 22 V during the 8 to 10 A starting surge.

External DC Input. See Fig. 3-2. Switches S161C and D select the external DC input voltage. The remainder of the circuit operates the same as the internal battery mode.

Meter and Cut-off Volts Circuit

Power Source-Charge. See Fig. 3-3. DC from the battery charger circuit is applied to the battery through CR126 and to the meter and cut-off voltage circuitry through R125

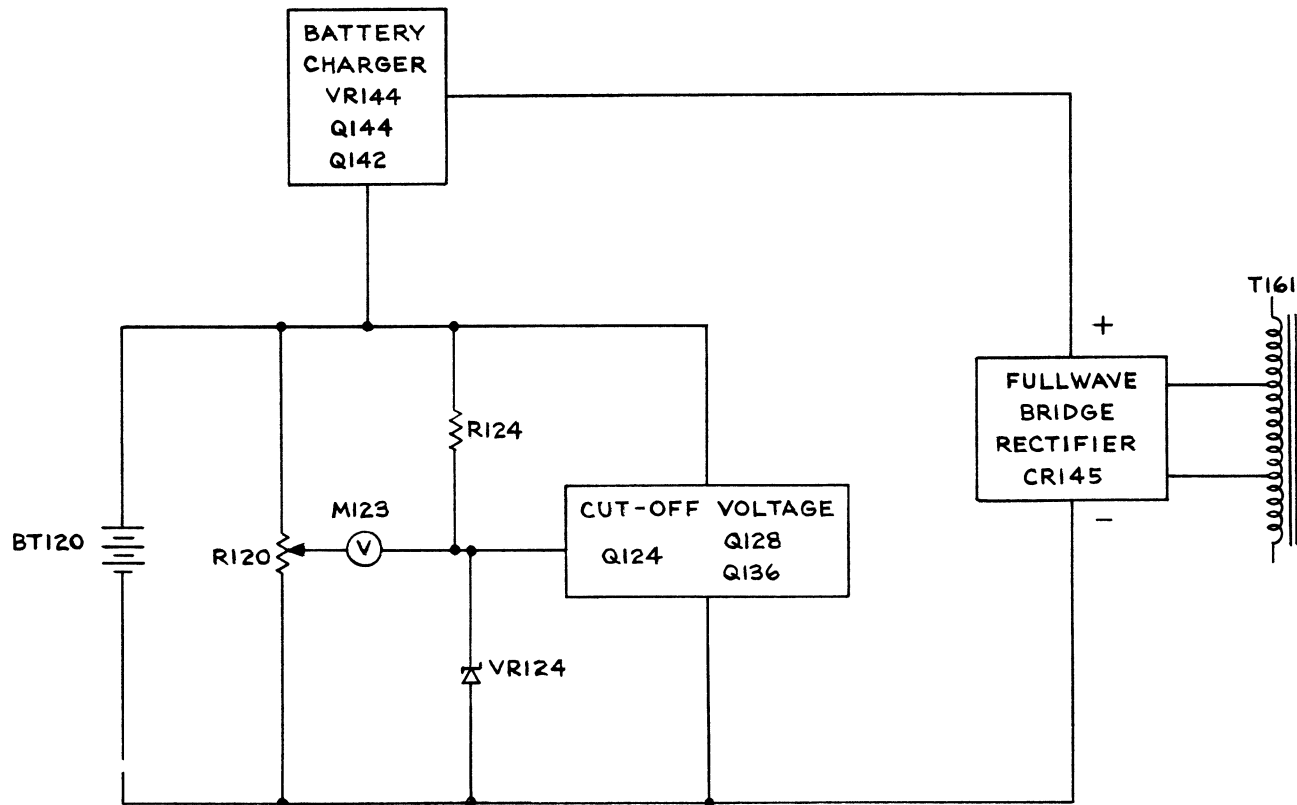


Fig. 3-1. Charging circuit block diagram.

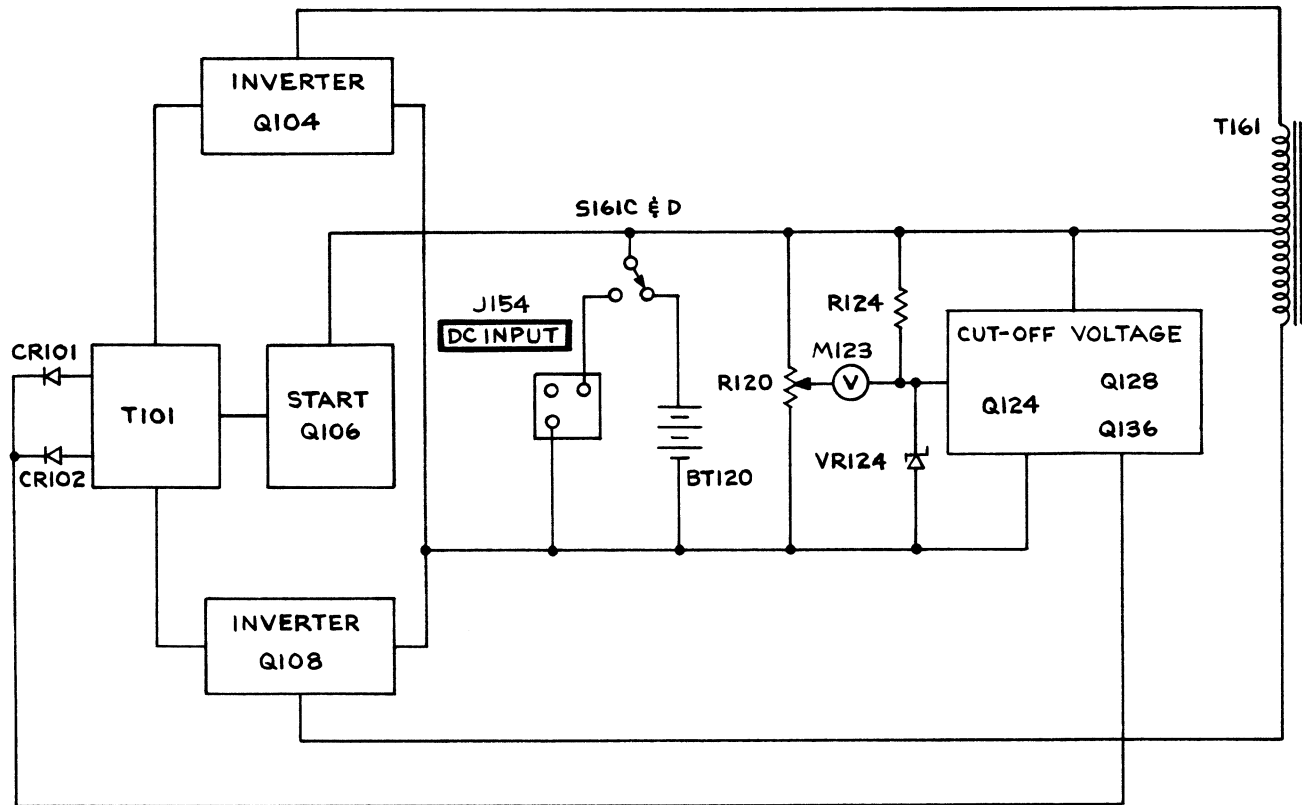


Fig. 3-2. Internal and external battery operation block diagram.

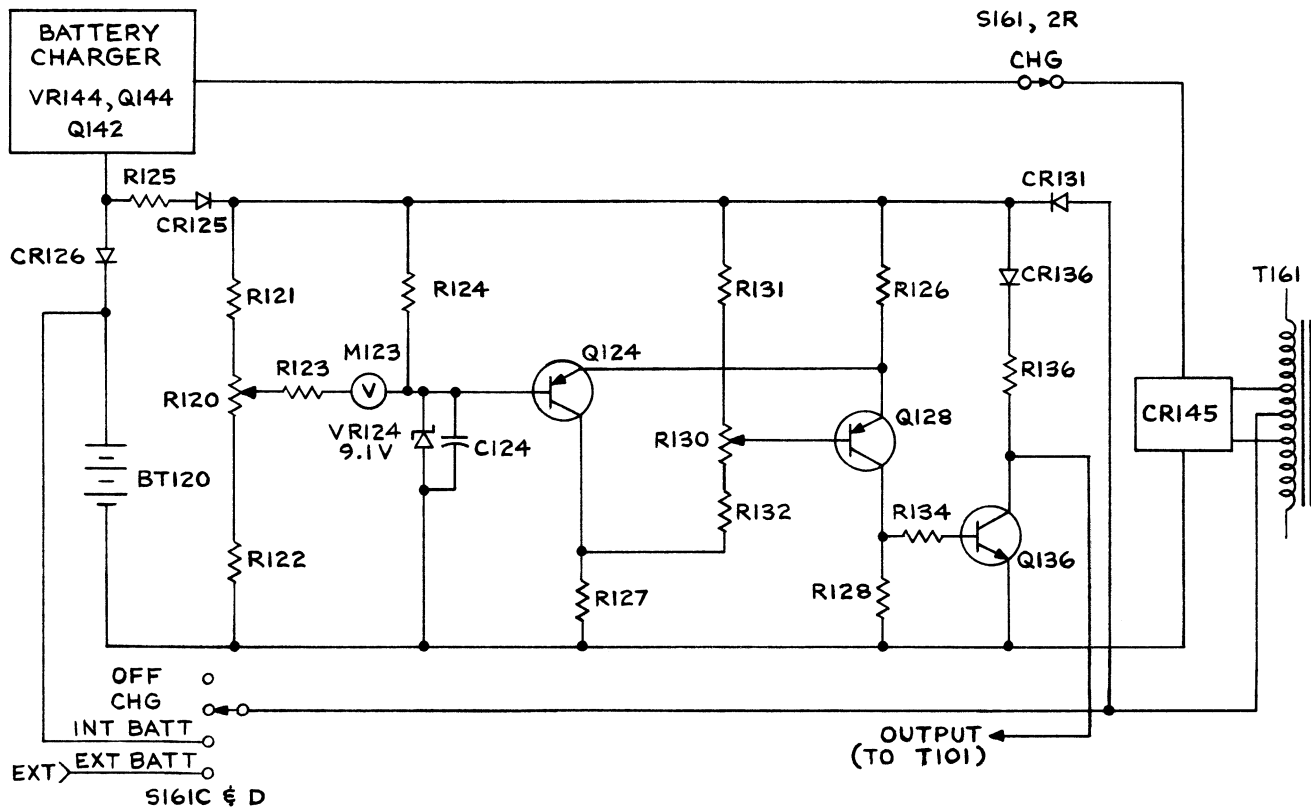


Fig. 3-3. Meter and cut off volts diagram.

and CR125. R125 is a dropping resistor to reduce the peak charging voltage to the meter circuit.

Power Source-Internal Battery. The mode switch, S161, section 2R (rear), disconnects the charger circuit from its power source. S161, C and D, connect the internal battery to the meter and cut-off volts circuitry through CR131. CR125 and CR126 are reverse biased through the charger circuitry, disconnecting the battery charger.

Power Source-External DC Input. The mode switch (S161C and D) connects the external DC input to the meter and cut-off circuitry. Contacts on the mode switch select taps on T161 primary to give the same output voltage with the different input voltages (internal battery, 22 to 28 V vs external DC, 24 to 30 V). See the complete schematic in section 6 for this wiring. The rest of the circuit operates the same as the internal battery mode.

Meter Circuit. The voltage reference for the meter circuit is set by R124 and VR124. The other side of the meter is connected via R123 to voltage divider R121, R120, and R122. R123 is a current limiting resistor for the meter. R120 is set for no meter current when the voltage across the divider is 22 V.

Cut-Off Volts Circuit. The voltage reference for the base of Q124 is set by R124 and VR124 for about 9.1 V. This establishes the junction of R126 and the emitters of Q124 and Q128 at about 9.7 V. C124 helps to hold the 9.1 V level, preventing inverter transients from activating the cut-off circuit.

Voltages higher than 22 V cause increased current through R126, Q124 and R127. Q128 is kept cut off by the increased voltage across R127, and the resulting change across divider R132-R130-R131. This permits no current through R128. Since R128 furnishes bias to Q136, the transistor is cut off. This permits the collector of Q136 and the output to rise to a voltage determined by the inverter circuit. This voltage is higher than the battery voltage. It is disconnected from the battery voltage by the reverse bias on CR136.

As the battery discharges, the total voltage across the circuit drops to less than 22 V. The current through divider R127, R132, R130 and R131 (and the base of Q128) is decreased. Q128 conducts, taking current from Q124, and causing less drop across R127. This makes Q128 conduct more and cuts Q124 off. Current flow through R128 turns Q136 on. Q136 saturates, dropping its collector voltage and the output to about 0.2 V. R134 limits maximum base current. CR101 and CR102 turn on, shorting T101 and stopping the inverter.

During internal battery operation, the voltage applied to the collector of Q136 by the inverter is higher than the battery voltage. CR136 is cut off by the higher voltage, preventing it from getting into the metering and cut-off circuitry.

Battery Charger Circuit

See Fig. 3-4. AC voltage is applied to a full wave bridge rectifier CR145, from part of the secondary of T161. The rectified voltage goes to the filter, C144, and R144, VR144. VR144 limits the voltage across R142, S142, R143, and the base-emitter junctions of Q142 and Q144 to about 4.3 V. The drop across the two base-emitter junctions reduces this voltage to about 3 V across R142, S142 and R143.

Under normal battery temperatures the thermal cut out S142 is closed and the 3 V across R143 ($5\ \Omega$) limits the charge current to about 0.6 A.

Battery temperature rises as the batteries reach full charge. S142 opens, adding R142 ($6.8\ \Omega$) in series with R143 and reducing the charging current to about 0.25 A.

Start-Inverter Circuit

Start Circuit. See Fig. 3-5. Battery voltage is applied to R111 and to Q104 and Q108 through T161. R111 and C111 decouple the start circuit. R106 and R107 limit the current through Q106.

The charge rate of C106 provides the bias for Q106 during the start sequence. The initial charge builds up to about 10 V through R107 and the emitter-base junction of Q106. At this point Q106 saturates and the charge rate is determined by R109 and by C106. C106 charges to approximately the battery voltage in about 30 milliseconds. CR106 is the base current path for Q104 and Q108, but is reverse biased by the starting surge.

Inverter Circuit. The starting surge is applied to the bases of Q104 and Q108 through T101, R104, and R108. Since the two transistors do not have identical parameters, one will conduct before the other and start the inverter.

R104, R108 and T101 primary plus R101, R102 and T101 secondary are the main frequency-determining components for the inverter. The four resistors also determine optimum drive to Q104 and Q108. Conduction through

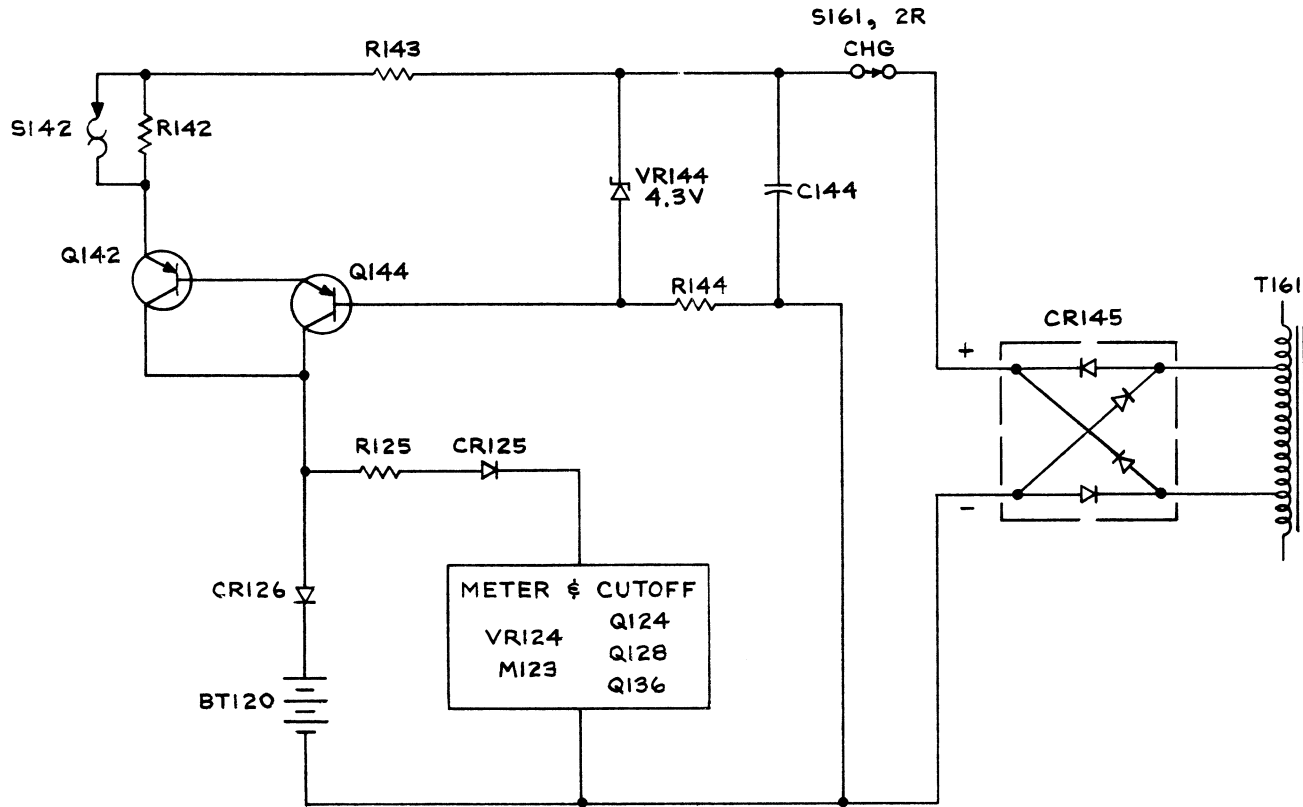


Fig. 3-4. Battery charger diagram.

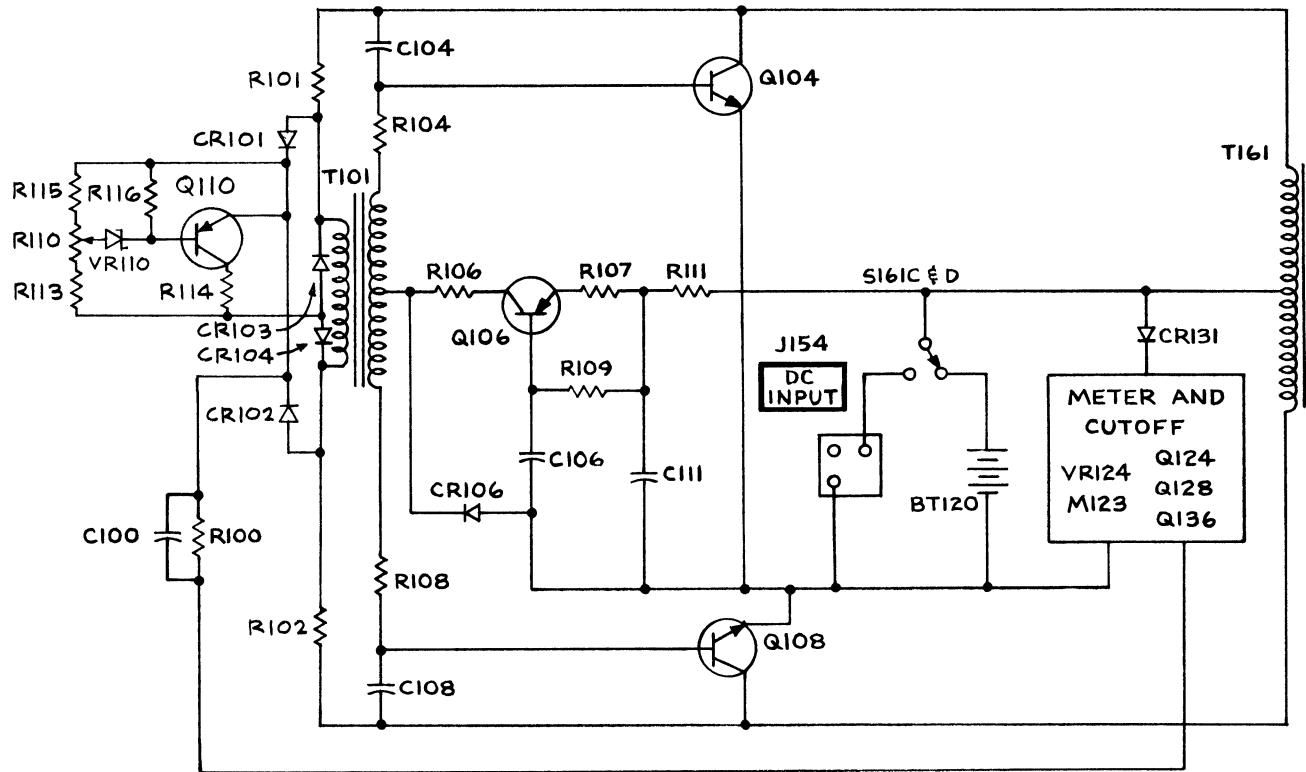


Fig. 3-5. Start-inverter diagram.

Q110 and R114 increases as battery voltage increases, providing additional frequency stability. Base current for Q110 is obtained from divider R115-R113-R110. R110 is set for the proper output frequency. VR110 and R116 provide a low-impedance base-current source for Q110. R114 limits the maximum current through Q110. Conduction during one half of the inverter cycle is through CR103, Q110, R114, and CR102. During the other half cycle it is through CR104, Q110, R114, and CR101. C104 and C108 degenerate the high frequency response and reduce transients.

When the battery voltage drops low enough to operate the cut-off circuit, the collector of Q136 drops from about 35 V to 0.2 V. R100 limits the amount of current that can

flow in CR101 and CR102. R100 and C100 provide a time constant sufficient to ensure that the collapsing field of T101 or transients don't restart the inverter.

The output of the inverter is coupled to the outlet plug through T161.

External DC Input

External power is applied to J154. CR154 is normally reverse biased. If external power of the wrong polarity is applied, CR154 becomes forward biased and blows fuse F154.

MAINTENANCE

Obtaining Replacement Parts

Standard Parts. All electrical and mechanical part replacements for the 1105 can be obtained through your local Tektronix Field Office or representative. However, many of the standard electronic components can be obtained locally in less time than is required to order them from Tektronix, Inc. Before purchasing or ordering replacement parts, check the parts list for value, tolerance, rating, and description.

Special Parts. In addition to the standard electronic components, some special components are used in the 1105. These components are manufactured or selected by Tektronix, Inc., to meet specific performance requirements, or are manufactured for Tektronix, Inc., in accordance with our specifications. Most of the mechanical parts used in this instrument have been manufactured by Tektronix, Inc. Order all special parts directly from your local Tektronix Field Office or representative.

Ordering Parts. When ordering replacement parts from Tektronix, Inc., include the following information:

1. Instrument type.

2. Instrument serial number.

3. A description of the part (if electrical, include circuit number).

4. Tektronix Part Number.

Battery Pack Service

Battery Pack. The battery pack is made up of 20 1.25 V Nickel-Cadmium (NiCd) cells strapped together. Background information regarding these cells is given in the Battery Operation section and should be read before any servicing is performed on the battery pack.

If one cell is defective and fails while the rest of the battery pack is still quite new, that cell may be replaced without undue concern. The Tektronix Field Representative or Office should be consulted before individual cells are replaced, especially if the warranty is in effect.

Gas evolution and recombination takes place during battery charging. This creates a pressure within the cells

which they normally can withstand. If a cell becomes defective, or a circuit failure causes the recommended charge rate to be exceeded, excessive pressure builds up. The pressure may rupture a relief vent, exhausting the gas. This action may shorten the life of the cell, and will coat the surrounding areas with a corrosive substance.

The battery pack should be inspected every six months or every 500 operating hours, whichever occurs first. Individual cells or the entire battery pack should be replaced if venting or excessive corrosion has occurred. The cover plate must be removed to expose the individual cells. Sight between the cells to check for obvious corrosion or venting.

Battery Pack Removal. Unplug the battery connector. Remove the two screws from the battery holding bracket. For ease in handling, the thermal cut-out leads may be unplugged from the circuit board and the block ground lead unsoldered.

Individual Cell Replacement. When necessary, individual cells can be removed and replaced by cutting the straps which connect the two ends of the cell to the pack, and soldering in a new cell. The cell type specified must be used. Other types may not function properly. They may

prove to be a hazard to the instrument and to personnel. Operating time or temperature performance may be degraded. The battery pack should be charged for 24 hours after individual cells are replaced.

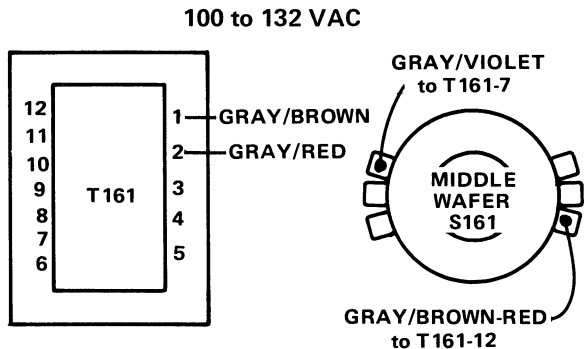
All cells in the battery pack should be made by the same manufacturer. Include this information, with the other information required, when ordering a replacement cell.

Line Voltage Selection Wiring

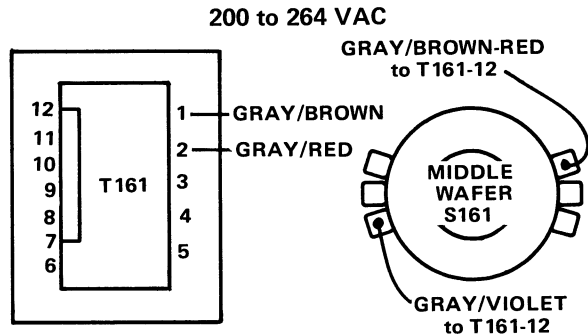
Charging Voltage	Connect as Shown
115 VAC (100 to 132 VAC)	Fig. 4-1a
230 VAC (200 to 264 VAC)	Fig. 4-1b
105 VAC (90 to 120 VAC)	Fig. 4-1c
210 VAC (180 to 240 VAC)	Fig. 4-1d

Ext DC Wiring

A DC power cord is provided to permit proper connection of the 1105 Power Supply to a suitable DC source. See Fig. 4-2a. Additional isolation may be needed between the 1105 Power Supply and the apparatus being used. The user may need to break the safety earth circuit. To offer

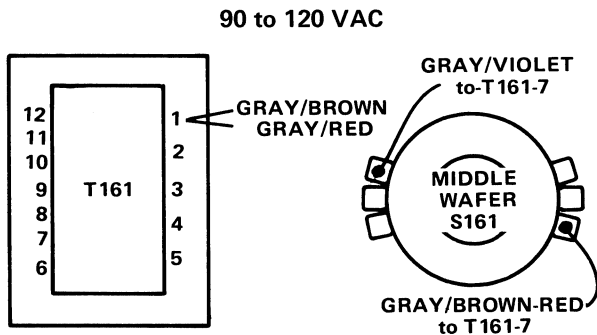


(a)

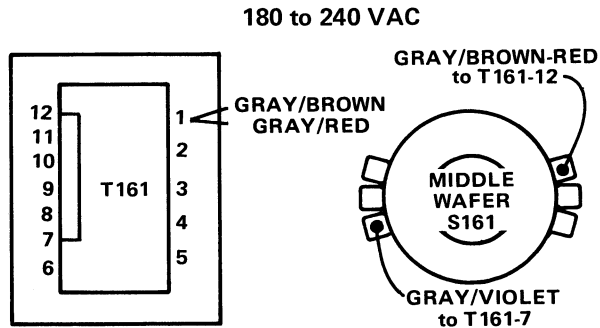


(b)

DO NOT remove the strap between the front and middle wafer.



(c)



(d)

DO NOT remove the strap between the front and middle wafer.

Fig. 4-1. Line Voltage Selection Wiring.

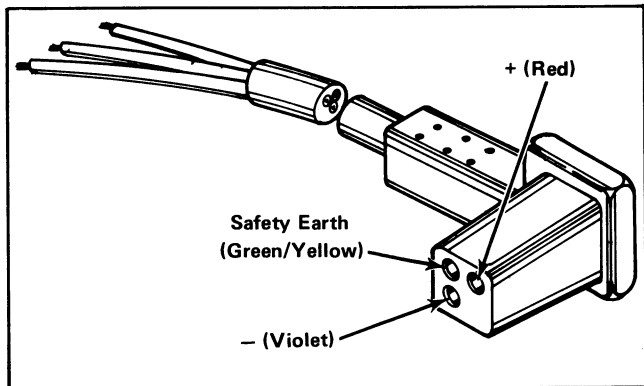


Fig. 4-2a. DC Power Cord Wiring.

maximum protection in this case do not break the safety earth ground circuit. Use a two-to-three wire adapter on the 1105 output. This grounds the 1105 Power Supply to the DC source and permits only the apparatus to be isolated from the safety earth circuit.

Option 1 Wiring

An AC power cord is provided with Option 1 to permit equipment not having an IEC power cord to be properly connected to the 1105 Power Supply Option 1. See Fig. 4-2b.

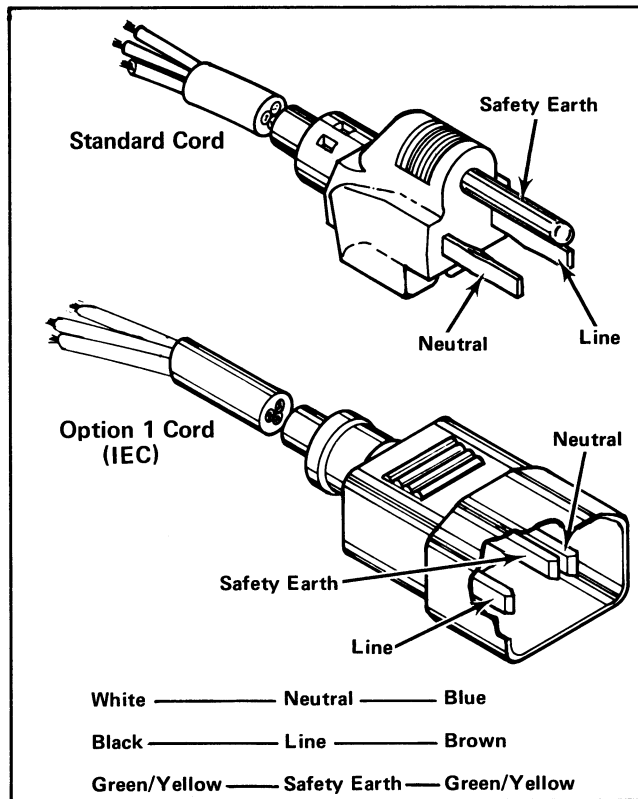


Fig. 4-2b. AC Power Cord Wiring.

CALIBRATION

Introduction

Supply Disassembly. For calibration, remove the four screws from the sides of the 1105 Power Supply and lift the top half (power supply) from the bottom half (battery pack).

For further mechanical disassembly see the exploded drawings at the back of this manual.

WARNING

Dangerous potential and high current capabilities exist at several points. Disconnect power cord and batteries before replacing parts or soldering.

Reference Letters. (A), (B), etc. refer to points indicated on the schematic and circuit board illustration.

Accuracy Considerations. The 1105 Power Supply is calibrated at the factory using a power supply having the specifications listed first under the equipment required list.

This permits the most accurate setting of the cut-off volts and meter zero, and accurate checking of load requirements. Because this type of power supply may not be available, several alternate possibilities are given. The alternate power supplies have drawbacks, including voltage stability vs time with high discharge rates, see Fig. 2-1.

The output amplitudes are approximate voltages. So are the checks of the charging current. The frequency accuracy is 60 Hz within 10%. Therefore, the choice of test equipment depends on how accurately the user wants to examine the 0.9 A maximum current limit.

Equipment Required

EXT. DC power source (DC supply). Voltage, variable, 22 V to 30 V. Greater than 30 V may cause damage to the 1105 Power Supply or to the equipment connected to it. A battery voltage of 22 V or less will cut off the 1105 Power Supply. Current-Starting surge is approximately 8 to 10 A, with or without a load. The source must be capable of handling this surge without dropping to 22 V or less. The following are acceptable alternative power supplies.

1. Variable power supply with the aforementioned capabilities.

2. Variable power supply with an adequate current rating, in series with items 4 or 5.

3. 1105 Power Supply battery pack.¹

4. Two 12-Volt wet cell storage batteries, in series, tapped at 20, 22 or 24 V.²

5. 18 to 23 NiCd batteries, 4.0 AH (D cells) or greater, furnishing 20 to 28 V.²

Output Loads. See Fig. 5-1 and Accuracy Considerations, and select a load that permits operation within the shaded area of Fig. 5-1. Maximum current occurs using one 153 Ω , +20%, -0%, for maximum output voltage, and 120 Ω , +20%, -0%, for the minimum output voltage.

¹To set meter zero and cut-off volts, the battery is charged above the cut-off point (22 V). A load is connected and the battery allowed to discharge while its voltage is being monitored. As it reaches 22 V the meter is set to zero and the cut-off point is set to cut off the supply.

²This does not permit accurate adjustment of meter zero and cut-off volts. NiCd batteries can be used, following the technique used for item 3.

Wattage ratings should be greater than 124 watts for the 153 Ω load and greater than 98 watts for the 120 Ω load. Use a 220 Ω , 60 watt, 10% resistor, or a 60-watt incandescent bulb for the frequency check.

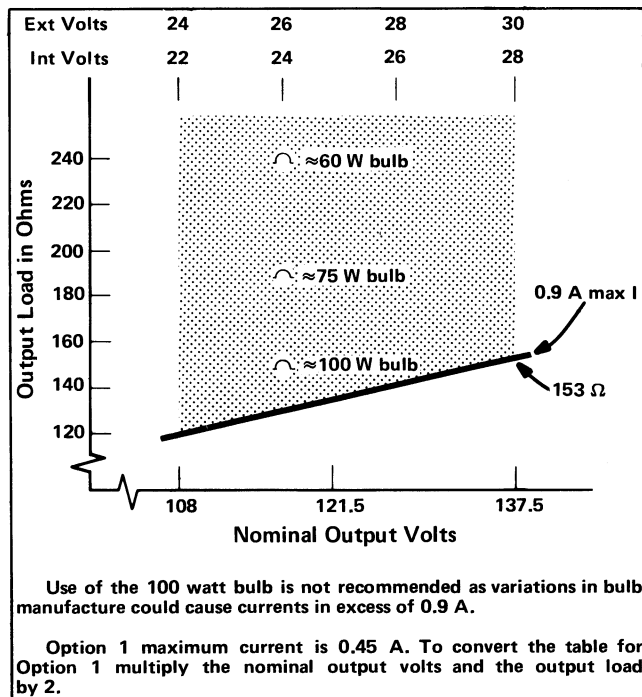


Fig. 5-1. Output load selection.

Discharged Battery Pack. A 40 Ω , 15 watt resistor may be substituted for the discharged battery pack. Required to verify the 1105 Power Supply charging rates.

Test Oscilloscope. Required to verify the 1105 Power Supply output frequency and amplitude.

DC Voltmeter. 22 V to 30 V. 1 V to 4 V.

CALIBRATION PROCEDURE FOR STANDARD INSTRUMENT

If the cut-off volts and the zero set adjustments are to be made, set cut-off V (R130) for minimum cut-off voltage.

Internal Battery

a. Connect the DC source to the internal battery connector. Connect the 153 Ω load to the 1105 Power Supply output. Set the mode switch to INT BATT. Adjust the DC source to 28 V between the common emitters of Q104-Q108 (A) and the fuse, F120 (B).

CHECK—Output voltage, using the test oscilloscope, should be approximately 137.5 V (C) to (D).

b. Set the DC source to 22 V. Replace the 153 Ω load with the 120 Ω load.

CHECK—Output voltage should be approximately 108 V.

CHECK—BATT LEVEL meter should read approximately zero.

ADJUST—Zero Set (R120) for a zero meter reading.

ADJUST—Cut-off V (R130) slowly until the 1105 Power Supply shuts off.

c. Set the DC source to 26 V. Replace the 120 Ω load with the 60 watt load. Restart the 1105 Power Supply by setting the mode switch to OFF, then INT BATT.

CHECK—Output frequency, with the test oscilloscope, should be 60 Hz within 10%.

d. Vary the DC source from 30 to 22 V while monitoring the output.

CHECK—Output frequency should be 60 Hz within 10%.

CHECK—Voltage across R104 or R108, with test oscilloscope, should be 1.8 V or more, peak to peak.

e. If the voltage across R104 or R108 is less than 1.8 V perform this step. R110 is to be adjusted for the best compromise between the correct frequency range vs. input voltage while maintaining sufficient base drive at the minimum input voltage. Set the DC source to 26 V. Use the 60 watt load.

ADJUST—Freq Set (R110) for 60 Hz.

Repeat step d.

If the voltage across R104 or R108 is still less than 1.8 V, set the DC source to 22 V.

ADJUST—Freq Set (R110) for 1.8 V across R104 or R108.

Repeat step d.

External Battery

a. Connect the DC source to the external DC INPUT, J154. Set the DC source for 24 V measured between the common emitters of Q104-Q108 (A) and the fuse F154 (E).

CHECK—Output voltage, using the test oscilloscope, should be approximately 108 V (C) to (D).

b. Replace the 120 Ω load with the 153 Ω load. Set the DC source to 30 V.

CHECK—Output voltage should be approximately 137.5 V.

c. Disconnect the test oscilloscope.

Charge

a. Connect a discharged battery pack (or a 40 Ω resistor) to the 1105 Power Supply internal battery connector. Connect the 1105 Power Supply to a 115 V AC source. Set the mode switch to CHG. Connect the voltmeter across R143 (F) and (G).

CHECK—Voltage should be approximately 3.0 V.

b. Disconnect the thermal cut-out, S142 by removing the plug at P142, pins 1 and 2.

CHECK—Voltage should be approximately 1.3 V.

c. Connect the thermal cut-out.

CALIBRATION PROCEDURE FOR OPTION 1

Use the following steps for Option 1. Then use the charge step given for the standard 1105 Power Supply. The output loads change value for Option 1.

If the cut-off volts and the zero set adjustments are to be made, set cut-off V (R130) for minimum cut-off voltage.

Internal Battery

a. Connect the DC source to the internal battery connector. Connect the $306\ \Omega$ load to the 1105 Power Supply output. Set the mode switch to INT BATT. Adjust the DC source to 28 V between the common emitter of Q104-Q108 (A) and the fuse F120 (B).

CHECK—Output voltage, using the test oscilloscope, should be approximately 275 V (C) to (D).

b. Set the DC source to 22 V. Replace the $306\ \Omega$ load with the $240\ \Omega$ load.

CHECK—Output voltage should be approximately 216 V.

CHECK—BATT LEVEL meter should read approximately zero.

ADJUST—Zero Set (R120) for a zero meter reading.

ADJUST—Cut-off V (R130) slowly until the 1105 Power Supply shuts off.

c. Set the DC source to 26 V. Replace the $240\ \Omega$ load with the 60 watt load. Restart the 1105 Power Supply by setting the mode switch to OFF, then INT BATT.

CHECK—Output frequency, with the test oscilloscope, should be 60 Hz within 10%.

d. Vary the DC source from 30 to 22 V while monitoring the output.

CHECK—Output frequency should be 60 Hz within 10%.

CHECK—Voltage across R104 or R108, with test oscilloscope, should be 1.8 V or more, peak to peak.

e. If the voltage across R104 or R108 is less than 1.8 V perform this step. R110 is to be adjusted for the best compromise between the correct frequency range vs. input

voltage while maintaining sufficient base drive at the minimum input voltage. Set the DC source to 26 V. Use the 60 watt load.

ADJUST—Freq Set (R110) for 60 Hz.

Repeat step d.

If the voltage across R104 or R108 is still less than 1.8 V set the DC source to 22 V.

ADJUST—Freq Set (R110) for 1.8 V across R104 or R108.

Repeat step d.

External Battery

a. Connect the DC source to the external DC INPUT, J154. Set the DC source for 24 V measured between the common emitters of Q104-Q108 (A) and the fuse F154 (E).

CHECK—Output voltage, using the test oscilloscope, should be approximately 216 V (C) to (D).

b. Replace the 240 Ω load with the 306 Ω load. Set the DC source to 30 V.

CHECK—Output voltage should be approximately 275 V.

CIRCUIT BOARD ILLUSTRATION, DIAGRAM, AND PARTS LISTS

Symbols and Reference Designators

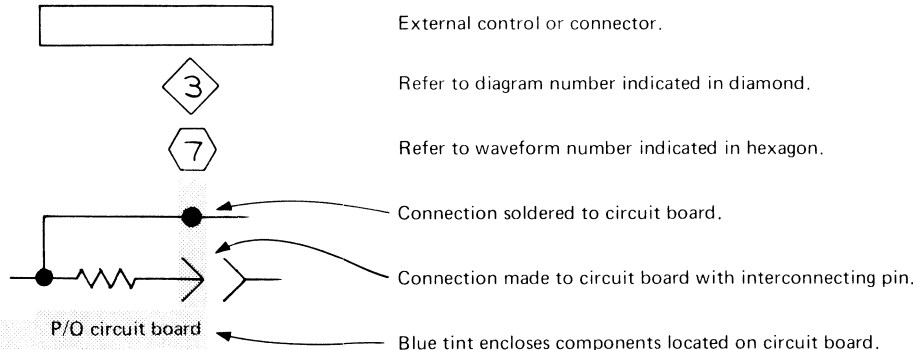
Electrical components shown on the diagrams are in the following units unless noted otherwise:

Capacitors = Values one or greater are in picofarads (pF).
Values less than one are in microfarads (μ F).
Resistors = Ohms (Ω)

Symbols used on the diagrams are based on ANSI Y32.2-1970 and IEEE No. 315 March 1971.

Logic symbology is based on MIL-STD-806B in terms of positive logic. Logic symbols depict the logic function performed and may differ from the manufacturer's data.

The following special symbols are used on the diagrams:



The following prefix letters are used as reference designators to identify components or assemblies on the diagrams.

A	Assembly, separable or repairable (circuit board, etc.)	P	Connector, movable portion
BT	Battery	R	Resistor, fixed or variable
C	Capacitor, fixed or variable	S	Switch
CR	Diode, signal or rectifier	T	Transformer
F	Fuse	TP	Test point
J	Connector, stationary portion	U	Assembly, inseparable or non-repairable (integrated circuit, etc.)
L	Inductor, fixed or variable	VR	Voltage regulator (zener diode, etc.)
Q	Transistor or silicon-controlled rectifier		

ELECTRICAL PARTS LIST

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
ASSEMBLY				
A1	670-2719-00			CONVERTER Circuit Board Assembly
BATTERY				
BT120 ¹	146-0020-00			Battery set (consists of 20 cells)
CAPACITORS				
C100	290-0574-00	B010100	B010116	47 μ F, Elect., 20 V, 10%
C100	290-0519-00	B010117		100 μ F, Elect., 20 V, 20%
C104	285-0919-00			0.22 μ F, Plastic, 100 V, 10%
C106	290-0528-00			15 μ F, Elect., 50 V, 20%
C108	285-0919-00			0.22 μ F, Plastic, 100 V, 10%
C111	290-0573-00			2.7 μ F, Elect., 50 V, 20%
C124	290-0574-00			47 μ F, Elect., 20 V, 10%
C144	290-0507-00			1800 μ F, Elect., 75 V, +75%–10%
C151	283-0024-00			0.1 μ F, Cer, 30 V, +80%–20%
C152	283-0024-00			0.1 μ F, Cer, 30 V, +80%–20%
C154	290-0509-00			3000 μ F, Elect., 50 V, +100%–10%

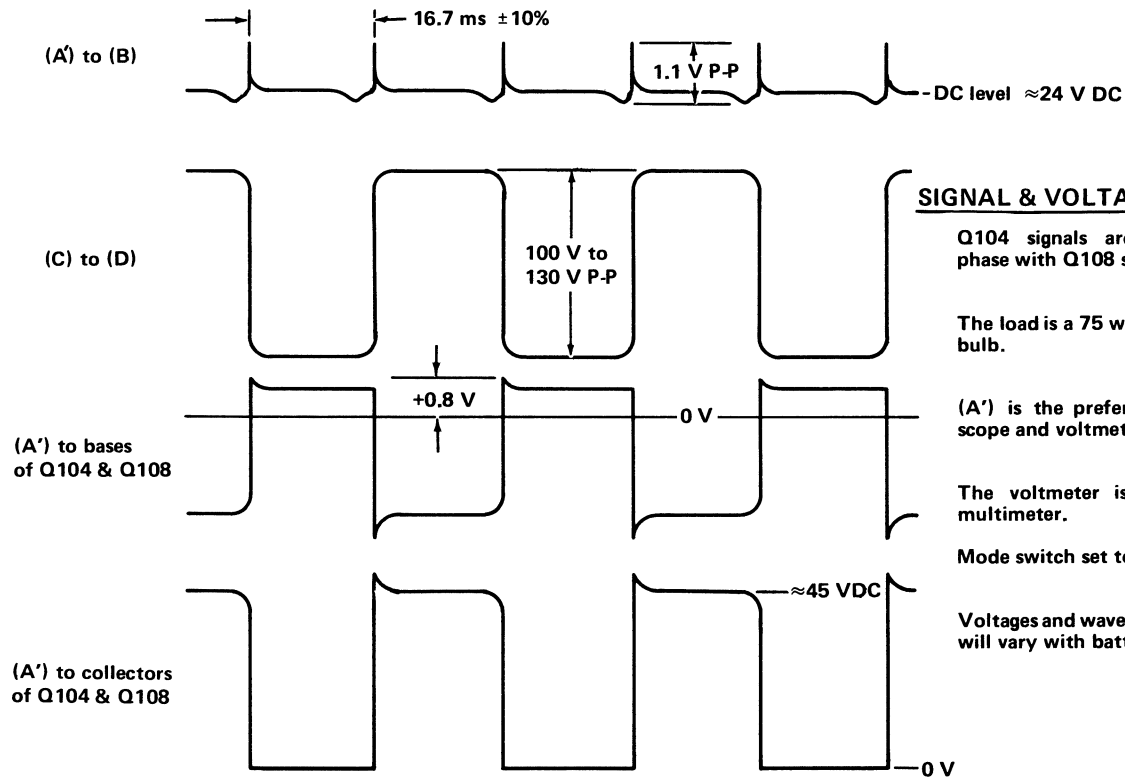
¹ For single cell order 146-0024-00.

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
DIODES, SILICON				
CR 101	152-0107-00			Silicon, T160 or 1N647
CR 102	152-0107-00			Silicon, T160 or 1N647
CR 103	152-0107-00			Silicon, T160 or 1N647
CR 104	152-0107-00			Silicon, T160 or 1N647
CR 106	152-0066-00			Silicon, diffused, selected from 1N3194
CR 125	152-0107-00			Silicon, T160 or 1N647
CR 126	152-0066-00			Silicon, diffused, selected from 1N3194
CR 131	152-0107-00			Silicon, T160 or 1N647
CR 136	152-0107-00			Silicon, T160 or 1N647
CR 145	152-0488-00			Silicon, bridge, full wave, 1.5 A, 200 V
CR 154	152-0198-00			Silicon, 1N4721
BULB				
DS161	150-0037-00			Neon, ST2-27S
FUSES				
F 120	159-0011-00			6.25 A, 3AG, slo-blo
F 154	159-0011-00			6.25 A, 3AG, slo-blo
F 161	159-0016-00			1.5 A, 3AG, fast-blo
F 162	159-0016-00			1.5 A, 3AG, fast-blo

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
CONNECTOR				
J154	131-1333-00			Receptacle, electrical, power
J162	131-1349-00			Receptacle, electrical, power, 15 A, 125 V
METER				
M123	149-0031-01			Battery level, 0-200 μ A
TRANSISTORS, SILICON				
Q104	151-0413-00			Silicon, NPN, 2N6258
Q106	151-0350-00			Silicon, PNP, 2N5401
Q108	151-0413-00			Silicon, NPN, 2N6258
Q110	151-0134-00			Silicon, PNP, 2N2905A
Q124	151-0301-00			Silicon, PNP, 2N2907
Q128	151-0301-00			Silicon, PNP, 2N2907
Q136	151-0302-00			Silicon, NPN, 2N2222A
Q142	151-0373-00			Silicon, PNP, MJE2901
Q144	151-0134-00			Silicon, PNP, 2N2905A
RESISTORS				
R100	303-0471-00	B010100	B010116	470 Ω , 1 W, 5%
R100	303-0301-00	B010117		300 Ω , 1 W, 5%
R101	308-0385-00			200 Ω , 3 W, WW, 5%
R102	308-0385-00			200 Ω , 3 W, WW, 5%
R104	308-0574-00			10 Ω , 2 W, WW, 5%
R106	301-0180-00			18 Ω , 1/2 W, 5%

Ckt. No.	Tektronix Part No.	Serial/Model No.		Description
		Eff	Disc	
RESISTORS (cont)				
R107	307-0103-00			2.7 Ω , 1/4 W, 5%
R108	308-0574-00			10 Ω , 2 W, WW, 5%
R109	315-0221-00			220 Ω , 1/4 W, 5%
R110	311-1225-00			1 k Ω , Var
R111	315-0100-00			10 Ω , 1/4 W, 5%
R113	315-0471-00			470 Ω , 1/4 W, 5%
R114	308-0252-00			390 Ω , 3 W, WW, 5%
R115	315-0362-00			3.6 k Ω , 1/4 W, 5%
R116	315-0103-00			10 k Ω , 1/4 W, 5%
R120	311-1226-00			2.5 k Ω , Var
R121	321-0293-00			11 k Ω , 1/8 W, 1%
R122	321-0279-00			7.87 k Ω , 1/8 W, 1%
R123	321-0213-00			1.62 k Ω , 1/8 W, 1%
R124	301-0272-00			2.7 k Ω , 1/2 W, 5%
R125	315-0470-00			47 Ω , 1/4 W, 5%
R126	322-0229-00			2.39 k Ω , 1/4 W, 1%
R127	315-0471-00			470 Ω , 1/4 W, 5%
R128	315-0102-00			1 k Ω , 1/4 W, 5%
R130	311-1226-00			2.5 k Ω , Var
R131	321-0301-00			13.3 k Ω , 1/8 W, 1%
R132	321-0271-00			6.49 k Ω , 1/8 W, 1%
R134	315-0101-00			100 Ω , 1/4 W, 5%

Ckt. No.	Tektronix Part No.	Serial/Model No. Eff	Disc	Description
RESISTORS (cont)				
R136	315-0153-00			15 k Ω , 1/4 W, 5%
R142	308-0503-00			6.8 Ω , 2.5 W, WW, 5%
R143	308-0179-00			5 Ω , 5 W, WW, 5%
R144	308-0291-00			2 k Ω , 3 W, WW, 5%
R161	315-0224-00			220 k Ω , 1/4 W, 5%
SWITCHES				
S142	260-1539-00			Thermostatic, open 122° F, $\pm 5^\circ$ F, close 107° F, $\pm 7^\circ$ F
S161	260-1528-00			Rotary
S161B	260-0760-00			Sensitive, SPDT
S161C	260-0760-00			Sensitive, SPDT
S161D	260-0760-00			Sensitive, SPDT
S161E	260-0760-00			Sensitive, SPDT
TRANSFORMERS				
T101	120-0843-00			Toroid, 3 windings
T161	120-0842-00			Power
DIODES, ZENER				
VR110	152-0243-00			Zener, 1N965B, 0.4 W, 15 V, 5%
VR124	152-0306-00			Zener, 1N960B, 0.4 W, 9.1 V, 5%
VR144	152-0395-00			Zener, 1N749A, 0.4 W, 4.3 V, 5%



SIGNAL & VOLTAGE CONDITIONS

Q104 signals are 180° out of phase with Q108 signals.

The load is a 75 watt incandescent bulb.

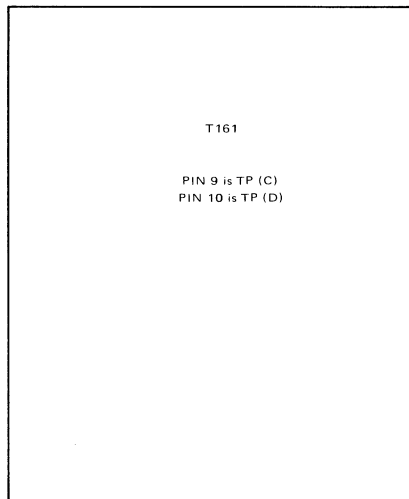
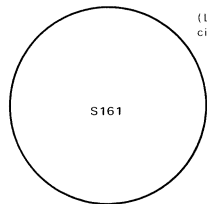
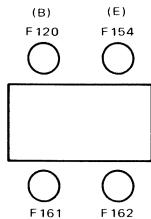
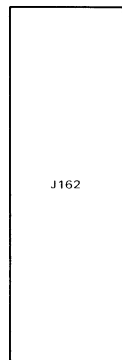
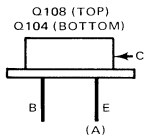
(A') is the preferred test oscilloscope and voltmeter ground.

The voltmeter is a $20,000 \Omega/V$ multimeter.

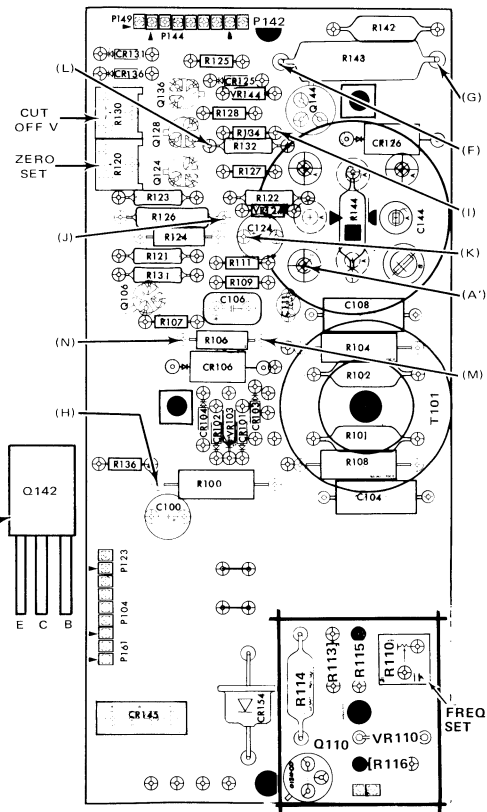
Mode switch set to INT BATT.

Voltages and waveform amplitudes will vary with battery voltage.

Typical Idealized Waveforms.



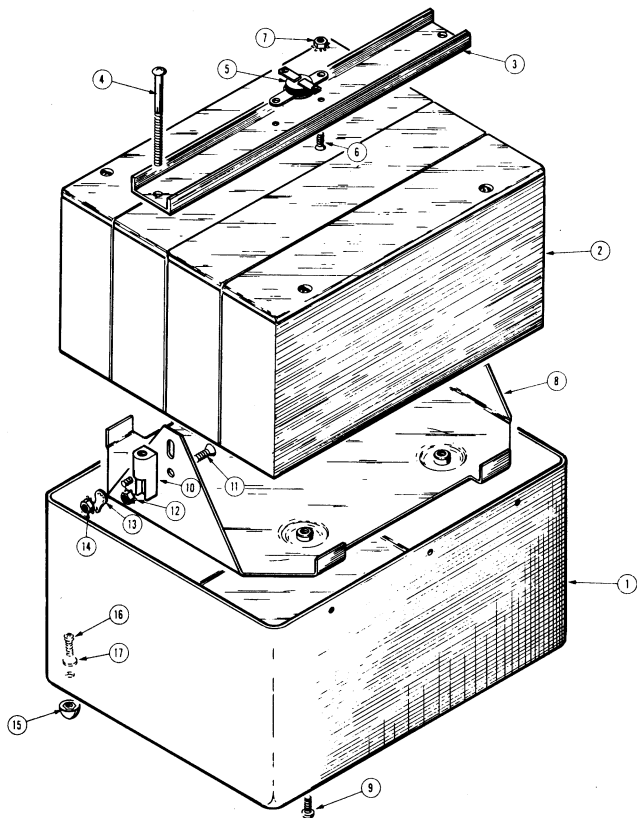
(Located under circuit board)



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FIG. 1 LOWER HOUSING & BATTERY PACK

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MECHANICAL PARTS LIST

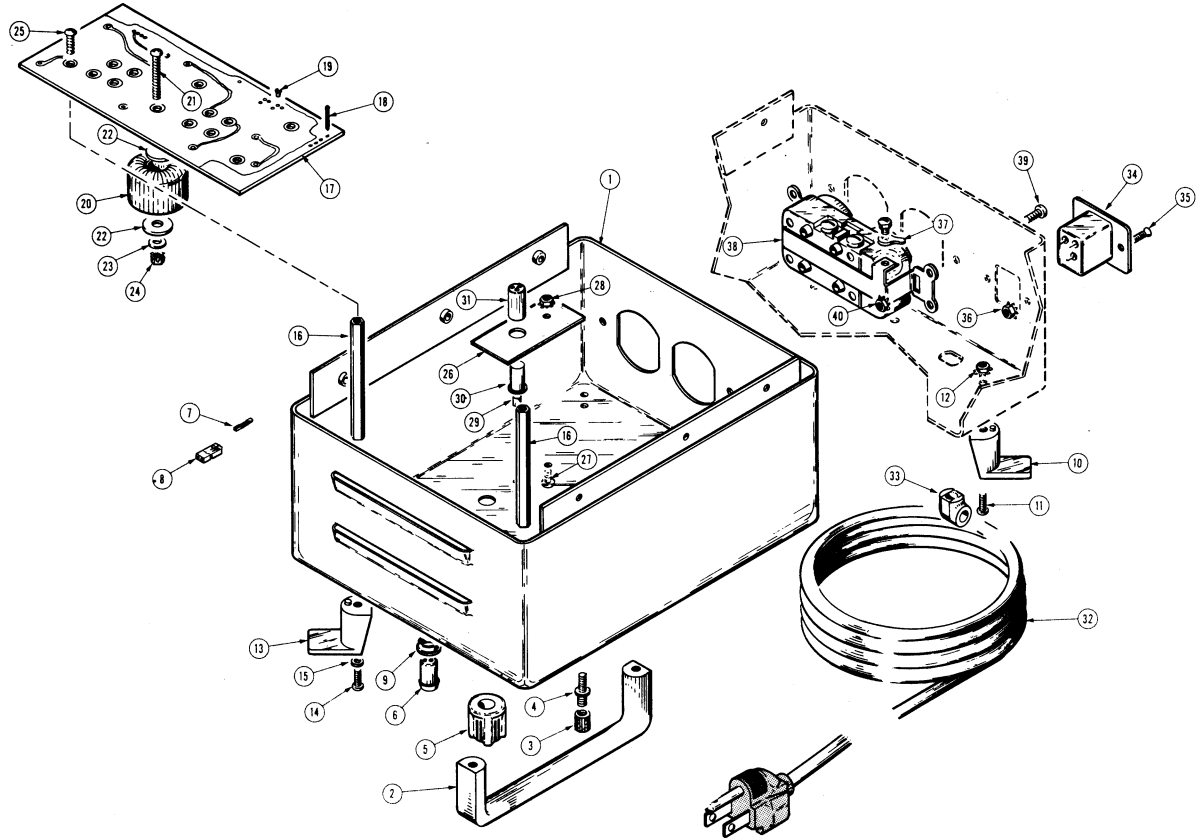
Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
1-1	380-0321-01			1						HOUSING, battery pack, lower
-2	146-0020-00			1						BATTERY SET
	-----			-						battery set includes:
	131-0947-00			1						CONNECTOR SHELL, male (not shown)
	131-0948-00			2						CONTACT, electrical, female (not shown)
-3	343-0424-00			1						HOLD-DOWN, batteries
	-----			-						mounting hardware: (not included w/hold-down)
-4	212-0102-00			2						SCREW, 8-32 x 2 inches, PHS
-5	260-1539-00			1						SWITCH, thermostatic
	-----			-						mounting hardware: (not included w/switch)
-6	211-0101-00			2						SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-7	210-0586-00			2						NUT, keps, 4-40 x 0.25 inch
-8	352-0359-00			1						HOLDER, batteries
	-----			-						mounting hardware: (not included w/holder)
-9	212-0003-00			4						SCREW, 8-32 x 0.25 inch, THS

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
1-10	220-0595-00 -----			2						NUT BLOCK
				-						mounting hardware: (not included w/nut block)
-11	211-0541-00			1						SCREW, 6-32 x 0.25 inch, 100° csk, FHS
-12	210-0407-00			1						NUT, hex., 6-32 x 0.25 inch
-13	210-0202-00 -----			1						LUG, solder, SE #6
				-						mounting hardware: (not included w/lug)
-14	210-0457-00			1						NUT, keps, 6-32 x 0.312 inch
-15	348-0080-01 -----			4						FOOT, cabinet
				-						mounting hardware for each: (not included w/foot)
-16	211-0510-00			1						SCREW, 6-32 x 0.375 inch, PHS
-17	210-0006-00			1						WASHER, lock, internal, #6

+

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FIG. 2 UPPER HOUSING



A

Mechanical Parts List-1105

6-13

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q					Description	
		Eff	Disc	t y	1	2	3	4		5
2-1	380-0320-01			1						HOUSING, battery pack, upper
	-----			-						mounting hardware: (not included w/housing)
	211-0565-00			6						SCREW, 6-32 x 0.25 inch, THS (not shown)
-2	367-0181-00			1						HANDLE, carrying
	-----			-						mounting hardware: (not included w/handle)
	212-0507-00			2						SCREW, 10-32 x 0.375 inch, PHS (not shown)
	210-0010-00			2						WASHER, lock, internal, #10 (not shown)
-3	200-0103-00			1						NUT, plain, knurled
-4	355-0507-00			1						STEM, binding post
	-----			-						mounting hardware: (not included w/stem)
	210-0583-00			1						NUT, hex., 0.25-32 x 0.297 inch (not shown)
	210-0046-00			1						WASHER, lock, internal, 0.261 ID x 0.40 inch OD (not shown)
-5	366-0500-00			1						KNOB, gray – OFF/ON
	-----			-						knob includes:
	213-0513-00			1						SETSCREW, 5-40 x 0.125 inch, HSS (not shown)

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1 2 3 4 5	Description
		Eff	Disc			
2-	149-0031-01			1		METER ASSEMBLY
	-----			-		meter assembly includes:
-6	149-0031-00			1		METER
-7	131-0708-00			2		CONNECTOR, terminal
-8	352-0169-00			1		HOLDER, terminal connector, 2 wire
-9	352-0243-00			1		HOLDER, indicator
-10	407-0322-00			2		BRACKET, power cord
	-----			-		mounting hardware for each: (not included w/bracket)
-11	211-0012-00			1		SCREW, 4-40 x 0.375 inch, PHS
-12	210-0586-00			1		NUT, keps, 4-40 x 0.25 inch
-13	407-0322-00			2		BRACKET, power cord
	-----			-		mounting hardware for each: (not included w/bracket)
-14	211-0012-00			1		SCREW, 4-40 x 0.375 inch, PHS
-15	210-0054-00			1		WASHER, lock, split, #4
-16	129-0352-00			1		POST, metallic, hex., 2.812 inches long
	388-3583-00	B0100	B0229X	1		CIRCUIT BOARD (not shown)
	-----			-		mounting hardware: (not included w/circuit board)
	211-0152-00	B0100	B0229X	1		SCREW, 4-40 x 0.625 inch, PHB
	166-0025-00	B0100	B0229X	1		SPACER, 0.25 inch long

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q					Description		
		Eff	Disc	t	y	1	2	3		4	5
2-17	----- ¹			1							CIRCUIT BOARD ASSEMBLY—CONVERTER
	-----			-							circuit board assembly includes:
-18	131-0608-00			18							TERMINAL, pin
-19	136-0252-04			15							SOCKET, pin connector
-20	----- ¹			1							COIL
	-----			-							mounting hardware: (not included w/coil)
-21	211-0529-00			1							SCREW, 6-32 x 1.25 inches, PHS
-22	214-0716-00			2							INSULATOR, bushing, washer
-23	210-0869-00			1							WASHER, plastic, 0.156 ID x 0.375 inch OD
-24	210-0457-00			1							NUT, keps, 6-32 x 0.312 inch
	-----			-							mounting hardware: (not included w/circuit board assembly)
-25	211-0116-00	B0100	B0229	2							SCREW, sems, 4-40 x 0.312 inch, PHB
	211-0116-00	B0300		3							SCREW, sems, 4-40 x 0.312 inch, PHB
-26	386-2554-00			1							PLATE, indicator light
	-----			-							mounting hardware: (not included w/plate)
-27	211-0565-00			1							SCREW, 6-32 x 0.25 inch, THS
-28	210-0457-00			1							NUT, keps, 6-32 x 0.312 inch

¹ See Electrical Parts List for part number.

Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
2-29	378-0541-00			1						LENS, lampholder, frosted
-30	352-0084-01			1						LAMPHO_LDER
-31	200-0643-00			1						CAP, lampholder
-32	161-0033-04			1						CABLE ASSEMBLY, power
-33	358-0323-00			1						BUSHING, strain relief
-34	131-1333-00			1						CONNECTOR, receptacle, electrical, power
	-----			-						mounting hardware: (not included w/connector)
-35	211-0101-00			2						SCREW, 4-40 x 0.25 inch, 100° csk, FHS
-36	210-0586-00			2						NUT, keps, 4-40 x 0.25 inch
-37	210-0202-00			1						LUG, solder, SE #6
-38	131-1349-00			1						CONNECTOR, receptacle, electrical, power, dual
	131-1370-00			1						CONNECTOR, receptacle, electrical, power, dual (opt. 1 only)
	-----			-						mounting hardware: (not included w/connector)
-39	211-0542-00			2						SCREW, 6-32 x 0.312 inch, THS
-40	210-0457-00			2						NUT, keps, 6-32 x 0.312 inch

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FIG. 3 CHASSIS & ACCESSORIES

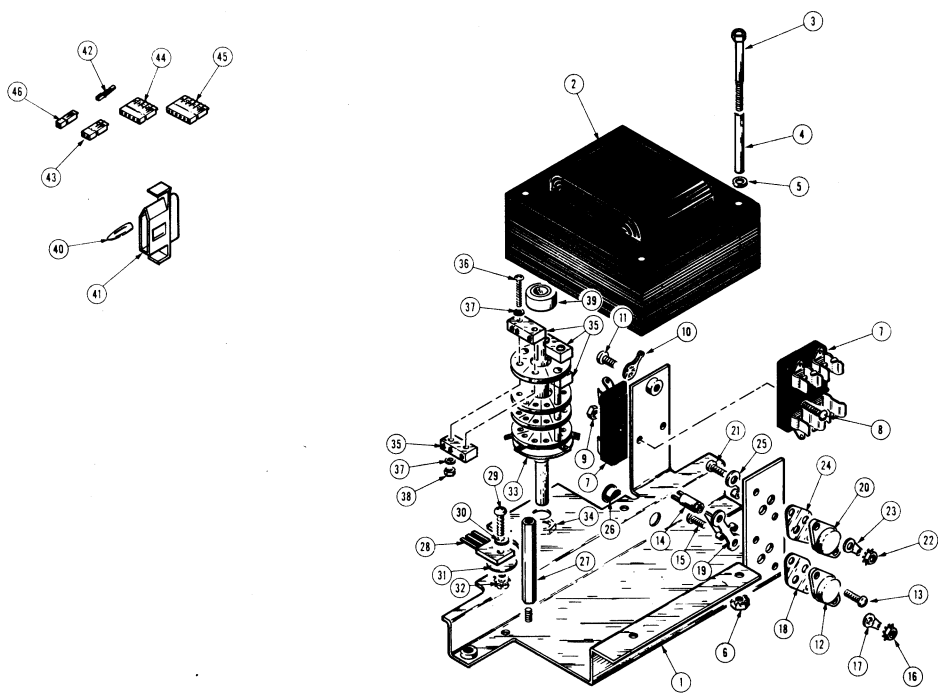


Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1	2	3	4	5	Description
		Eff	Disc							
3-1	441-1147-00			1						CHASSIS, battery pack
	-----			-						mounting hardware: (not included w/chassis)
	212-0003-00			3						SCREW, 8-32 x 0.25 inch, THS (not shown)
-2	----- ¹			1						TRANSFORMER
	-----			-						mounting hardware: (not included w/transformer)
-3	212-0590-00			4						SCREW, 10-32 x 1.50 inches, HSS
-4	166-0226-00			4						TUBE, insulating
-5	210-0812-00			4						WASHER, fiber, #10
-6	220-0410-00			4						NUT, keps, 10-32 x 0.375 inch
-7	352-0025-00			2						HOLDER, fuse, dual
	-----			-						mounting hardware: (not included w/holder)
-8	211-0511-00			2						SCREW, 6-32 x 0.50 inch, PHS
-9	210-0407-00			2						NUT, hex., 6-32 x 0.25 inch
-10	210-0205-00			1						LUG, solder, SE #8
	-----			-						mounting hardware: (not included w/lug)
-11	212-0001-00			1						SCREW, 8-32 x 0.25 inch, PHS

¹ See Electrical Parts List for part number.

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Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1 2 3 4 5					Description
		Eff	Disc							
3-12	----- ¹			1						TRANSISTOR
	-----			-						mounting hardware: (not included w/transistor)
-13	211-0504-00			1						SCREW, 6-32 x 0.25 inch, PHS
-14	131-0775-00			1						TERMINAL, stud
-15	211-0507-00			1						SCREW, 6-32 x 0.312 inch, PHS
-16	210-0457-00			1						NUT, keps, 6-32 x 0.312 inch
-17	210-0202-00			1						LUG, solder, SE #6
-18	386-0978-00			1						INSULATOR, plate, mica
-19	342-0026-00			1						INSULATOR, transistor, plastic
-20	----- ¹			1						TRANSISTOR
	-----			-						mounting hardware: (not included w/transistor)
-21	211-0507-00			2						SCREW, 6-32 x 0.312 inch, PHS
-22	210-0457-00			2						NUT, keps, 6-32 x 0.312 inch
-23	210-0202-00			1						LUG, solder, SE #6
-24	386-0978-00			1						INSULATOR, plate, mica
-25	342-0026-00			1						INSULATOR, transistor, plastic
-26	348-0056-00			1						GROMMET, plastic
-27	129-0417-00			1						POST, hex., 2.75 inches long

¹See Electrical Parts List for part number.

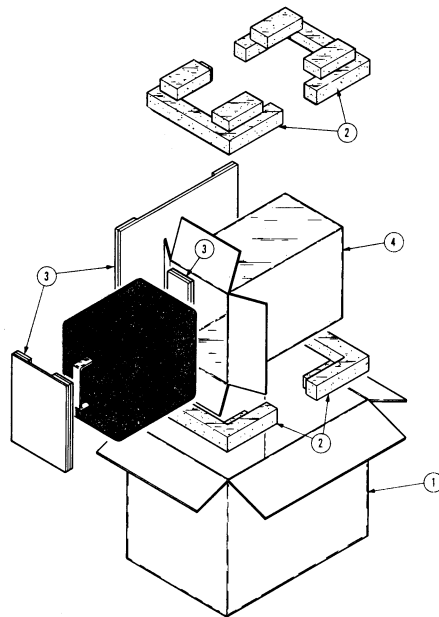
Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y						Description
		Eff	Disc		1	2	3	4	5	
3-28	----- ¹			1						TRANSISTOR
	-----			-						mounting hardware: (not included w/transistor)
-29	211-0012-00			1						SCREW, 4-40 x 0.375 inch, PHS
-30	210-0071-00			1						WASHER, spring tension
-31	342-0136-00			1						INSULATOR, washer, mica
-32	210-0586-00			1						NUT, keps, 4-40 x 0.25 inch
-33	260-1528-00			1						SWITCH, rotary
	-----			-						mounting hardware: (not included w/switch)
-34	210-0413-00			1						NUT, hex., 0.375-32 x 0.50 inch
-35	260-0760-00			4						SWITCH, SPDT
	-----			-						mounting hardware: (not included w/switches)
-36	211-0100-00			4						SCREW, 2-56 x 0.75 inch, PHS
-37	210-0001-00			8						WASHER, lock, internal, #2
-38	210-0405-00			4						NUT, hex., 2-56 x 0.187 inch
-39	105-0474-00			1						ACTUATOR, switch
-40	131-0945-00			2						CONTACT, electrical, male

¹See Electrical Parts List for part number.

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Fig. & Index No.	Tektronix Part No.	Serial/Model No.		Q t y	1 2 3 4 5	Description
		Eff	Disc			
3-41	131-0946-00			1		CONNECTOR SHELL, female
-42	131-0707-00			2		CONNECTOR, terminal
-43	352-0169-00			1		HOLDER, terminal connector, 2 wire
	179-1891-00			1		WIRING HARNESS—MAIN
	-----			-		wiring harness includes:
	131-0707-00			11		CONNECTOR, terminal
-44	352-0163-00			1		HOLDER, terminal connector, 5 wire
-45	352-0164-00			1		HOLDER, terminal connector, 6 wire
	179-1890-00			1		WIRING HARNESS—AC
	-----			-		wiring harness includes:
	131-0707-00			3		CONNECTOR, terminal
	352-0169-00			1		HOLDER, terminal connector, 2 wire
-46	352-0171-00			1		HOLDER, terminal connector, 1 wire
ACCESSORIES						
	161-0094-01			1		CABLE ASSEMBLY, power (not shown)
	161-0086-00			1		CABLE ASSEMBLY, power, option 1 only (not shown)
	070-1479-00			1		MANUAL, instruction (not shown)

FIG. 4 REPACKAGING



- 4- 065-0194-00
-
- 1 004-0867-00
- 2 004-0259-00
- 3 004-1167-00
- 4 004-0868-00

- 1 CARTON ASSEMBLY
- carton assembly includes:
- 1 BOX, outer
- 2 FRAME
- 1 PAD-SET
- 1 BOX, inner

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